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# COME RICONOSCERE I DRS IN ETA' EVOLUTIVA



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# Definizione

**TABLE 1 Definizione disturbi respiratori nel sonno e sue entità cliniche**

<b>Disturbi respiratori nel sonno</b>	<b>Sindrome di disfunzione delle alte vie aeree durante il sonno</b> Caratterizzata da russamento e/o sforzo respiratorio con aumentata resistenza delle alte vie aeree e collassabilità faringe.
<b>Entità cliniche dei Disturbi respiratori nel sonno</b>	
<b>Russamento primario</b>	Russamento abituale (>3 notti/settimana) senza apnee, ipopnee, arousal o anormalità scambio dei gas.
<b>Sindrome da aumentata resistenza delle vie aeree</b>	Russamento , frequenti arousal, aumentato lavoro respiratorio ma non riscontrati eventi ostruttivi o anormalità nello scambio dei gas.
<b>Ipoventilazione ostruttiva</b>	Russamento, elevati livelli di pressione parziale CO <sub>2</sub> a fine espirazione in assenza di eventi ostruttivi
<b>Sindrome delle apnee ostruttive nel sonno</b>	Episodi ricorrenti di parziale o completa ostruzione delle alte vie aeree (ipopnea, apnea ostruttiva o mista) con alterazione della normale ossigenazione, della ventilazione e dell'architettura del sonno.

# Obstructive sleep disordered breathing in 2–18 year-old children: diagnosis and management

Athanasios G. Kaditis<sup>1</sup>, Maria Luz Alonso Alvarez<sup>2</sup>, An Boudewyns<sup>3</sup>, Emmanouel I. Alexopoulos<sup>4</sup>, Refika Ersu<sup>5</sup>, Koen Joosten<sup>6</sup>, Helena Larramona<sup>7</sup>, Silvia Miano<sup>8</sup>, Indra Narang<sup>9</sup>, Ha Trang<sup>10</sup>, Marina Tsaoussoglou<sup>1</sup>, Nele Vandebussche<sup>11</sup>, Maria Pia Villa<sup>12</sup>, Dick Van Waardenburg<sup>13</sup>, Silke Weber<sup>14</sup> and Stijn Verhulst<sup>15</sup>

## **STEP 1: Child at risk for SDB if (one or more):**

- 1.1** Symptoms of upper airway obstruction (snoring, apnoea, restless sleep, oral breathing)
- 1.2** Findings on exam (tonsillar hypertrophy, obesity, midface deficiency, mandibular hypoplasia, neuromuscular disorders, Down syndrome, Prader–Willi syndrome)
- 1.3** Objective findings related to SDB (lateral neck radiography, flexible nasopharyngoscopy, cephalometry, upper airway MRI or CT)
- 1.4** Prematurity or family history of SDB

# Obstructive sleep disordered breathing in 2–18 year-old children: diagnosis and management

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## **STEP 2: Recognition of morbidity and conditions coexisting with SDB:**

### **2.1 Morbidity**

#### *Cardiovascular system*

- a) Elevated blood pressure
- b) Pulmonary hypertension and cor pulmonale

#### *Central nervous system*

- a) Excessive daytime sleepiness
- b) Inattention/hyperactivity
- c) Cognitive deficits/academic difficulties
- d) Behavioural problems

#### *Enuresis and somatic growth delay or growth failure*

#### *Decreased quality of life*

### **2.2 Conditions coexisting with SDB (probably common pathogenesis)**

- a) History of recurrent otitis media or tympanostomy tube placement
- b) Recurrent wheezing or asthma
- c) Metabolic syndrome
- d) Oral-motor dysfunction

# Pediatric obstructive sleep apnea: diagnosis and management

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**DEFINITION** Obstructive sleep apnea (OSA) is a respiratory disorder characterized by the reduction or cessation of airflow in the patient's airways during sleep.

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## RISK FACTORS

The main risk factors are the adenotonsillar hypertrophy and obesity. Other ones are prematurity, craniofacial anomalies, neuromuscular diseases, genetic syndromes, asthma and allergic rhinitis.

## TREATMENT

The first line is adenoidectomy and/or tonsillectomy. For severe or refractory cases, the use of CPAP may be considered. Also, it is essential that the treatment of OSA in children is organized by a multidisciplinary team, and it may involve more than one line of treatment.

## CLINICAL SYMPTOMS

The symptoms are snoring, obstructed breathing during sleep, sleepiness, behavioral and/or cognitive problems. Nighttime sweating, sleep enuresis, headaches on awakening and mouth breathing can be other clinical findings.

## DIAGNOSIS

Clinical and polysomnographic criteria, with an obstructive apnea-hypopnea index (OAH) of  $\geq 1$  respiratory event per hour of sleep, excluding other disorders.<sup>(3)</sup>

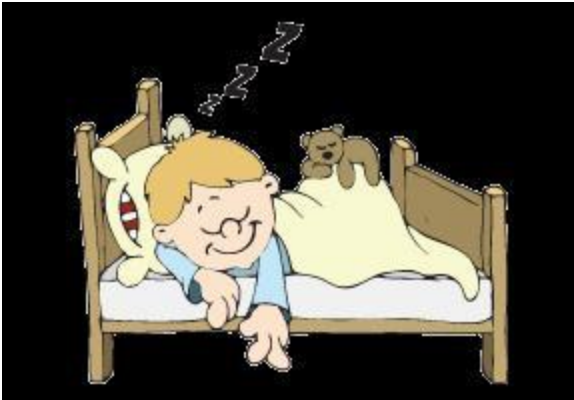
# *Epidemiologia*

La prevalenza dei disturbi respiratori del sonno in età prescolare e scolare varia ampiamente:

## **3,2% al 27% per il russamento**

- Nella maggior parte degli studi 1/3 dei bambini di età compresa tra i 2-6 anni dichiara di russare occasionalmente.
- 10-14% di russare frequentemente.

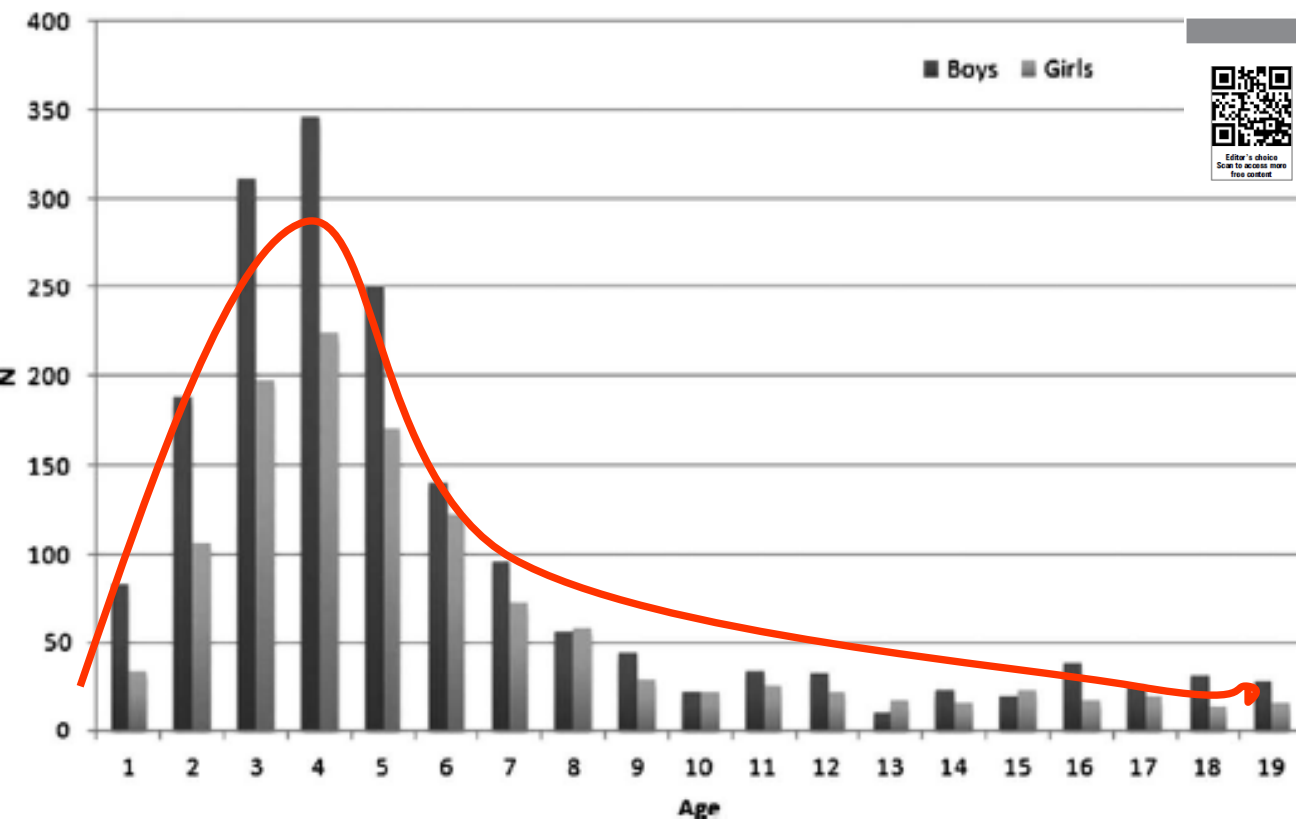
## **1,2% al 5,7% per l'OSAS**



*Lumeng JC Proc Am Thorac Soc 2008; Bixler EO Sleep 2009; Li AM Chest 2010; Shenghui Li Respiratory Research 2010; Marcus C Pediatrics 2012*

# Epidemiologia

Le apnee ostruttive nel sonno interessano i bambini di tutte le età, dal neonato all'adolescente, con una **maggiore prevalenza in età prescolare (dai 2 ai 6 anni)**.



Sleep disordered breathing



ORIGINAL ARTICLE

Morbidity and mortality in children with obstructive sleep apnoea: a controlled national study

Poul Jennum,<sup>1,2</sup> Rikke Ibsen,<sup>3</sup> Jakob Kjellberg<sup>4</sup>

Jennum P, et al. *Thorax* 2013;**68**:949–954.

**Sostanziale decremento  
dopo i 9 anni**

# Il pediatra...

Anamnesi ed esame obiettivo sono fondamentali per l'identificazione di bambini a rischio....

**Table 1.** Common Symptoms and Signs of Pediatric OSAS by Age

Infants, 3–12 months	Toddlers, 1–3 years	Preschool-aged children	School-aged children
Disturbed nocturnal sleep with repetitive crying	Noisy breathing or snoring	Regular, heavy snoring	Regular, heavy snoring
Noisy breathing or snoring	Restless nocturnal sleep	Mouth breathing	Restless nocturnal sleep
Nocturnal sweating	Abnormal sleeping positions	Restless nocturnal sleep	Sleepwalking
Poor suck	Nocturnal sweating	Sleepwalking	Sleep talking
Failure to thrive	Mouth breathing	Night terrors	Excessive bruxism
Delayed development	Night terrors	Enuresis	Difficulty to wake up in the morning
Apparent life-threatening event	Poor eating	ADHD-like symptoms	Morning headache
	Failure to thrive	Increased need for napping	Poor appetite
	Poor growth	Poor eating	Excessive daytime sleepiness Aggressiveness
		Growth problems	Emotional instability
			Learning difficulties



**Complicanze cardiovascolari,  
metaboliche, neurologiche...**

**Russamento notturno  
Difficoltà apprendimento,  
aggressività, sonnolenza...**

**Russamento notturno  
Respirazione orale  
Iperattività/disattenzione**

**Russamento notturno  
Respirazione orale**

**Russamento notturno  
ALTE**



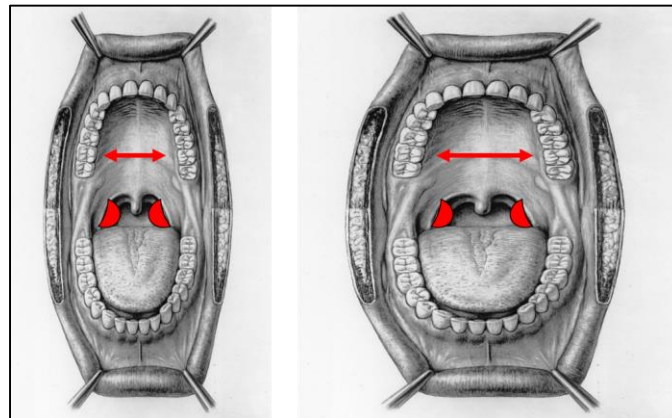
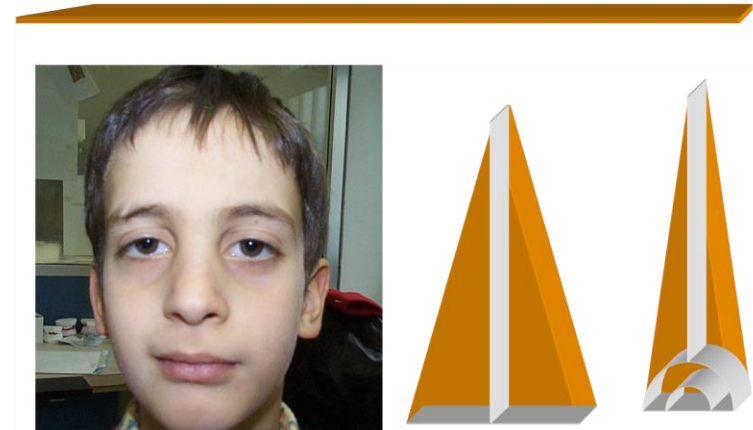
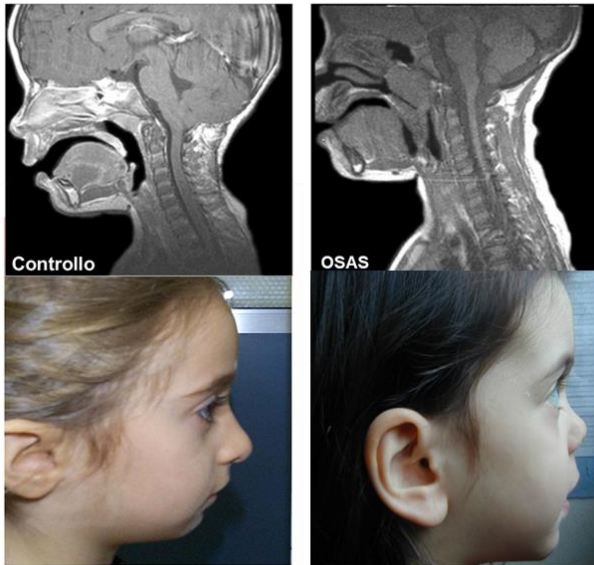
# **COSA GUARDO ?**



# Struttura anatomo-funzionale:

## Contrazione del mascellare

Struttura craniofacciale



Considerare non solo il volume tonsillare ma anche l'ampiezza della cavità orale

Enlarged Tonsils & Adenoids

Nasal Constriction

Allergic Rhinitis

Enlarged Tonsils & Adenoids

Nasal Constriction

Deviated Nasal Septum

Enlarged Turbinates

Cysts, Polyps & Tumors

Allergic Rhinitis

**NASOPHARYNGEAL OBSTRUCTION**

Blockage of eustacian tubes

M

Forward head & shoulder posture

Mouth breathing

Lowered tongue posture

Mandible with retruded & lowered posture

Otitis m (middle infect)  
Hearing

Constricted r

Lack of space

Malocclusions, crowding, overbites, crossbites, loss of vertical dimension

Speech problems, lisps, hyponasality

Malocclusions, open bites, long face syndrome, prognathism

Airway obstruction tongue against or wall, or soft

Difficulty eating

Poor nutrition

Susceptibility to disease

Bruxism

Craniomandibular dysfunction

TMJ dysfunction

TMJ condyle & disc displacement

TMJ degeneration & osteoarthritis

Neuro-muscular dysfunction

Myofacial pain

Headaches, neckaches, ear pain/ringing/ fullness, hearing loss, visual problems, limited or painful opening of jaw, neurologicv disorders such as Parkinson's, Tourette syndrome

May result in lack of skeletal muscle strength & coordination

Increased nasal mucus secretions

Stagnation of pathogens in nasal cavity

Sinusitis

Allergic shiners under eyes, due to venus puddng

Lowered oxygen intake

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Respirazione Orale

# Risk Factors for Obstructive Sleep Apnea Syndrome in Children: State of the Art

## IPERTROFIA ADENO-TONSILLARE

**Table 3.** Studies that have analyzed adenoid and/or tonsil hypertrophy as a pediatric OSAS risk factor.

Study	Year	Type of Study	Patients n°	Age	Parameters Evaluated	Conclusions
Kumatowski P. et al. [33]	2007	Case-control study	225	10–13	Age and sex; Total sleep time; AHI, ODI; AT grade sec. Friedman; Spielberger test; Capra and Pastorelli scale	Negative emotional effect of adenotonsillar hypertrophy induced obstructive sleep disordered breathing
Brietzke S.E. et al. [34]	2006	Meta-analysis (14 studies)	28 (mean)	4.9 (pooled mean age)	Age; Pre AT AHI; Post AT AHI; Success of AT;	AT effective in reducing severity of OSAS in majority of patients
Kang K.T. et al. [38]	2017	Meta-analysis (4 studies)	18.25 (mean)	8.3 ± 1.1 (mean)	Age; BMI; Other comorbidities; CT, RMN, DISE; Preoperative AHI; Postoperative AHI Preoperative ODI; Postoperative ODI	Effectiveness of lingual tonsillectomy for children with OSA caused by lingual tonsil hypertrophy
Lee C.F. et al. [41]	2016	Meta-analysis (11 studies)	11 (mean)	3.7 (mean)	Age; BMI; Preoperative AHI; Postoperative AHI Preoperative ODI; Postoperative ODI	Effectiveness in reducing AHI and MinSaO <sub>2</sub> , but complete resolution not achieved in most cases



Grade	Description
0	No tonsils seen
I	In tonsillar fossa
II	Visible beyond anterior pillars
III	Extended $\frac{3}{4}$ of way to midline
IV	Completely obstructing airway (kissing tonsils)

# Risk Factors for Obstructive Sleep Apnea Syndrome in Children: State of the Art

## INFLAMMATORY FACTORS AND BIOMARKERS

**Table 6.** Studies that have analyzed inflammatory factors and biomarkers as pediatric OSAS risk factors.

Study	Year	Type of Study	Patients n°	Age	Parameters Evaluated	Conclusions
Gozal D. et al. [59]	2007	Prospective study	355	5–7	AHI, RDI, SaO <sub>2</sub> ; Neurocognitive tests; Blood draw.	Positive correlation between APOE epsilon4 allele and OSA and neurocognitive deficits
Khalyfa A. et al. [60]	2011	Case-control study	140	<6	ESS questionnaire; AHI, RDI, SaO <sub>2</sub> M; Serum TNF- $\alpha$	Positive correlation between high TNF- $\alpha$ levels and OSAS
Tam C.S. et al. [79]	2006	Case-control study	113	7.3 $\pm$ 3.7	C-reactive protein; Cytokines: IL-1beta, IL-2, IL-4, IL-6, IL-8, IL-10, IL-12, GM-CSF, IFN-gamma and TNF-alpha.	Significantly elevated IFN-gamma levels and elevated IL-8 levels
Gozal et al. [80]	2008	Case-control study	40	6.5 $\pm$ 0.7	Age and sex; Ethnicity; BMI; AHI, RDI; IL-6, IL-10.	Higher levels of IL-6 and IL-10
Park C.S. et al. [85]	2014	Case-control study	67	6 (3–16)	Age and sex; BMI; AHI, RDI; OSA-18 questionnaire; Alpha amilase levels.	High level of serum alpha amilase in severe OSAS children compared to moderate and mild ones and to the control group
Gozal D. et al. [86]	2009	Case-control study	60	6.6 $\pm$ 0.7	Clinical questionnaires; Height and weight; BMI; AHI; RDI, SaO <sub>2</sub> ; Urine collection	Consistent alterations in urinary concentrations of specific protein clusters in OSA patients

# **Morning Levels of C-Reactive Protein in Children with Obstructive Sleep-disordered Breathing**

Athanasios G. Kaditis, Emmanouel I. Alexopoulos, Efthimia Kalamouka, Eleni Kostadima, Anastasios Germenis, Elias Zintzaras, and Konstantinos Gourgoulianis

Departments of Pediatrics, Pediatric Pulmonology Unit, Immunology, and Biomathematics, and Sleep Disorders Laboratory, University of Thessaly School of Medicine and Larissa University Hospital, Larissa, Greece

**Am J Respir Crit Care Med 2005**

# **Childhood Obesity, Inflammation, and Apnea**

What Is the Future for Our Children?

C Marcus **Am J Respir Crit Care Med 2005**

# **Plasma adhesion molecules in children with sleep-disordered breathing.**

O'Brien LM, Serpero LD, Tauman R, Gozal D.

*Chest. 2006*

# **C-Reactive Protein and Carotid Intima-Media Thickness in Children with Sleep Disordered Breathing**

Iannuzzi A et al. **J Clin Sleep Med 2013 May 15;9(5):493-8**

# **Metabolic Alterations and Systemic Inflammation in Obstructive Sleep Apnea among Nonobese and Obese Prepubertal Children**

**Am J Respir Crit Care Med. 2008 15; 177(10): 1142–1149**

David Gozal<sup>1</sup>, Oscar Sans Capdevila<sup>1</sup>, and Leila Kheirandish-Gozal<sup>1</sup>

# Risk Factors for Obstructive Sleep Apnea Syndrome in Children: State of the Art

Table 5. Studies that have analyzed craniofacial abnormalities and genetics as a pediatric OSA risk factor.

Study	Year	Type of Study	Patients Number	Age	Parameters Evaluated	Conclusions
Follmar A. et al. [58]	2014	Retrospective cohort study	118	1 day–15 years	RDI; Laryngomalacia; macroglossia, AT hypertrophy; GERD.	Multifactorial etiology of RSD in children affected by Prader–Willi Syndrome
Onodera K. et al. [62]	2005	Case–control study	30	3.8 ± 1.4 (20) 7.9 ± 3 (10)	Questionnaire items: Snoring; AHI; Mouth breathing; Occlusion; Height and weight; Ages of the eruption of deciduous teeth	Significant presence of RSD in patients affected by achondroplasia (AP)
Pavone M. et al. [66]	2015	Retrospective study	88	1–14.5	Anthropometric data; BMI; MOAHI, RDI, SpO2	No correlations between MOAHI and age or BMI, positive correlations between MOAHI and SpO2
Guilleminault C. et al. [67]	2013	Retrospective study	34 patients	26.55	Clinical evaluation; Rhinomanometry; AHI, RDI, SaO2	Commonly unrecognized abnormal breathing and its correlation with daytime fatigue and poor sleep in Ehlers–Danlos patients
Kalaskar R et al. [69]	2012	Case report study	1	11 years old boy	Anatomical finding; orthodontic conformation	Association between Ellis–van Creveld syndrome and OSA
Cardiel Rios S.A. et al. [71]	2016	Case report study	1	10 years old boy	Anatomical finding; orthodontic conformation	Association between Noonan syndrome, malocclusion and OSA
Saxby C. et al. [74]	2018	Retrospective study	65	Not specified	Patients demographics; Type of midface advancement; Preoperative: AHI, RDI, SaO2; Postoperative: AHI, RDI, SaO2; Blood pressure;	Positive outcomes after midface advancement in patients with craniosynostosis
Villa M.P. et al. [77]	2002	Randomized controlled study	32	4–10	Brouillette questionnaire; physical examinations: AHI, RDI, SaO2	Improved respiratory symptoms in patients who underwent oral appliance treatments

## CRANIOFACIAL ANOMALIES AND GENETICS

# Risk of sleep-disordered breathing in orthodontic patients: comparison between children and adolescents

## Abstract

**Objective:** The aim of this study was to assess the risk of sleep-disordered breathing (SDB) in orthodontic patients and to evaluate the influence of sex, age, and orthodontic treatment in a cohort of subjects using the Pediatric Sleep Questionnaire (PSQ) screening tool.

**Methods:** Parents of 245 patients aged 5-18 years ( $11.4 \pm 3.3$  years) were invited to participate in the study by answering the PSQ, which has 22 questions about snoring, sleepiness, and behavior. The frequency of high and low risk was calculated for the full sample. Multiple logistic regression was used to assess the association among sex, age, orthodontic treatment, rapid maxillary expansion (RME), and body mass index (BMI) with SDB. A significance level of 5% ( $P < .05$ ) was adopted in all tests.

**Results:** A high risk of SDB was found in 34.3% of the sample. No sex and BMI difference was found for the risk of SDB. The high risk of SDB was significantly associated with younger ages (OR = 1.889,  $P = .047$ ), pre-orthodontic treatment phase (OR = 3.754,  $P = .02$ ), and RME (OR = 4.157,  $P = .001$ ).

**Limitations:** Lack of ear, nose and throat-related medical history.

**Conclusion:** **Children showed a 1.8 higher probability of having a high risk of SDB compared** with adolescents. Patients before orthodontic treatment and patients submitted to RME showed a high risk of SDB.



... Una interposizione linguale può, dunque, dar luogo a distorsioni differenti: a seconda delle zone delle pressioni e delle intensità di queste pressioni... E sul piano dinamico andrà a creare - soprattutto - delle lesioni ATM: come nel caso qui in basso che in Occlusione Funzionale risulta



Nel caso seguente sono riuniti, nel medesimo bambino di 4 anni, tutti gli elementi che possono generare dei disturbi di crescita bucco-dentale legati alle malposizioni della lingua :

- Respirazione orale
- Frenulo linguale corto
- Pollice (suzione del)
- Beanza
- Deglutizione atipica
- assenza di Masticazione



da cui la necessità d'intercettazione precoce, spesso pluridisciplinare !  
E' impensabile lasciare che tali distorsioni si evolvano per un periodo ulteriore ...

- **The interaction between tongue size/volume and craniofacial skeletal growth is essential for understanding the mechanism of specific types of malocclusion and objectively measuring outcomes of various surgical and/or orthodontic treatments.**
- **Results suggest that reducing tongue body volume in young animals slows craniofacial skeletal growth and anterior dental arch expansion during rapid growth.**
- **The mandible, in particular its symphysis portion, and the anterior dental arch width are most affected.**
- **These effects may in part contribute to the decrease of functional loads in the anterior mouth by a volume-reduced tongue.**

# Risk Factors for Obstructive Sleep Apnea Syndrome in Children: State of the Art

**Table 4.** Studies that have analyzed allergic rhinitis as a pediatric OSA risk factor.

Study	Year	Type of Study	Patients n°	Age	Parameters Evaluated	Conclusions
Cao Y. et al. [51]	2018	Meta-analysis (44 studies)	6086 total patients	47.97 (adults) 7.73 (children)	Age and Sex; BMI; Neck circumference; AHI; ESS; AR prevalence	Children with OSA suffering from a higher incidence of AR. OSA adults with AR do not have any influences on sleep parameters
Kheirandish-Gozal L. et al. [52]	2014	Retrospective review	3071	2–14	Age and Sex; BMI; Pretreatment: AT grade; Mallampati; Total sleep time; AHI, ODI; Posttreatment: Pretreatment: AT grade; Mallampati; Total sleep time; AHI, ODI	Effective alternative to adenotonsillectomy, particularly in younger and non-obese Children
Kheirandish-Gozal L. et al. [53]	2016	Prospective randomized trial study	92	2–10	Age and Sex; BMI; Pretreatment: AT grade; Mallampati; Total sleep time; AHI, ODI; Posttreatment: Pretreatment: AT grade; Mallampati; Total sleep time; AHI, ODI	Beneficial effects (reduction of AHI and ODI) in 71% of children treated with montelukast. No changes in those treated with placebo.
Brouillette R.T. et al. [54]	2001	Triple-blind randomized placebo-controlled trial	25	1–10	Age and Sex; Pretreatment: AHI, ODI; Total sleep time; AT grade; AR symptoms Posttreatment: AHI, ODI; Total sleep time; AT grade; AR symptoms	Decrease in AHI/ODI values in 12/13 of fluticasone group. No changes in placebo group

## ALLERGIC RHINITIS

# The complex link between sleep-disordered breathing and asthma control in pediatric patients: A cross-sectional study

## Abstract

**Background:** In children, asthma and sleep-disordered breathing (SDB) may affect quality of life (QoL), and SDB may complicate asthma management.

**Objective:** To evaluate the prevalence of SDB, its association with asthma control, and risk factors associated with SDB in a cohort of asthmatic children. The effects of asthma control and SDB on QoL were also investigated.

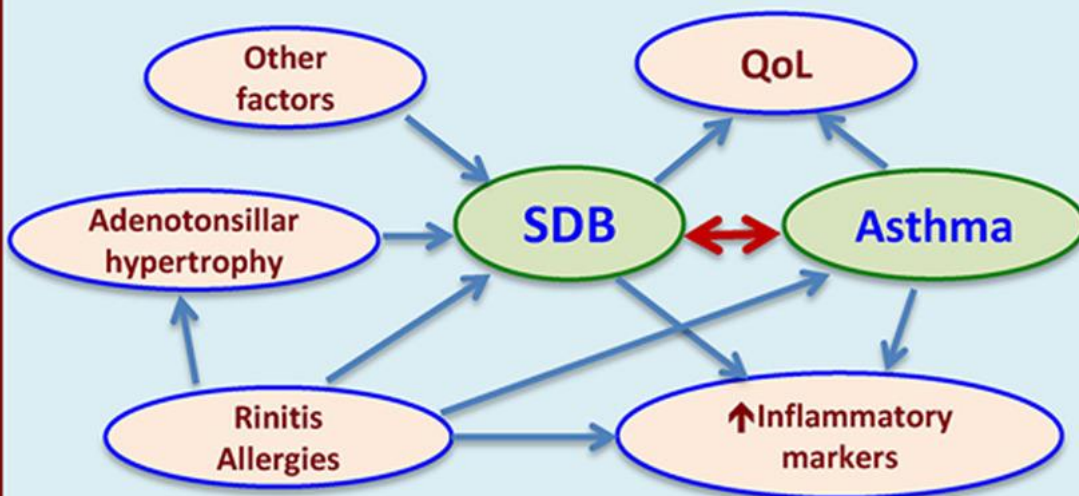
**Methods:** We consecutively recruited asthmatic children referred to our Pulmonology Service from December 1, 2022 to May 31, 2023. Data on anthropometrics, respiratory function, and allergies were collected. The prevalence of SDB was assessed by the Pediatric Sleep Questionnaire (PSQ). Asthma control status was assessed by the Childhood Asthma Control Test (C-ACT), while QoL was evaluated by the Pediatric Quality of Life Inventory (PedsQL) questionnaire. Factors associated with SDB were analyzed.

**Results:** A total of 78 asthmatic children aged 5-12 years were included. SDB was found in 37.2% of them, with a higher prevalence in children with uncontrolled versus well-controlled asthma (60.1% vs. 27.3%;  $p$ -value = 0.005). The C-ACT score was significantly lower in SDB-positive versus SDB-negative group, and uncontrolled asthma (C-ACT  $\leq 19$ ) was associated with a 4.15-fold increased risk of SDB. The PedsQL score was significantly lower in asthmatic children with than without SDB and was associated with lower SDB risk. SDB increased the risk of uncontrolled asthma in children, and asthmatic children with SDB had lower QoL.

**Conclusion:** In asthmatic children, SDB affects both asthma control and QoL. Children with uncontrolled asthma should be referred for polysomnography to identify a possible underlying SDB.

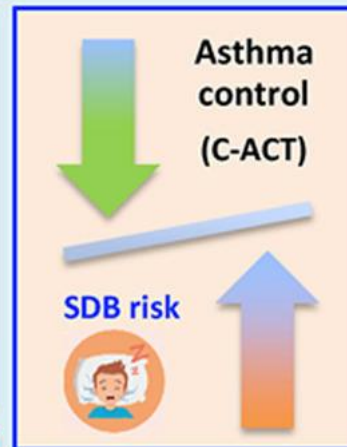
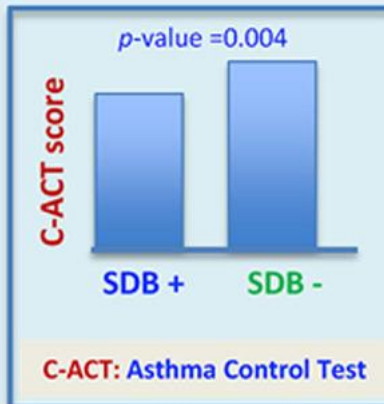
# SLEEP-DISORDERED BREATHING AND ASTHMA CONTROL IN CHILDHOOD

## LITERATURE FINDINGS

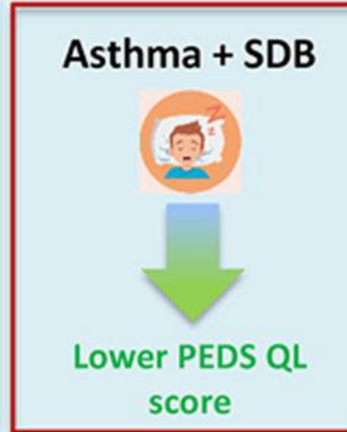


- Bidirectional relationship between **Sleep-Disordered Breathing (SDB)** and **Asthma**: (a) SDB shares important risk factors and comorbidities with Asthma; (b) inflammation plays a pathogenic role in both conditions.
- **SDB**: (a) more common in asthmatic vs. non-asthmatic children; (b) diagnosed more frequently in children with severe asthma.
- **Uncontrolled asthma**: commonly associated with respiratory exacerbations and SDB.

## OUR FINDINGS



- **Uncontrolled asthma** (C-ACT  $\leq 19$ ): associated with a 4.15-fold increased risk of SDB.
- **PEDS QL** (Quality of Life) score: associated with a lower risk of SDB (p-value = 0.002).



# Short Lingual Frenulum and Obstructive Sleep Apnea in Children

## Abstract

**Background:** Abnormal short lingual frenulum may lead to impairment of orofacial growth in early childhood. This may reduce the width of the upper airway—a pliable tube—increasing its risk of collapse, particularly during sleep.

**Study:** A retrospective study of prepubertal children referred for suspicion of obstructive sleep apnea, found 27 subjects with non-syndromic short lingual frenulum. The children had findings associated with enlarged adenotonsils and/or orofacial growth changes.

**Results:** Children with untreated short frenulum developed abnormal tongue function early in life with secondary impact on orofacial growth and sleep disordered breathing (SDB).

After presence of SDB, analysis of treatment results revealed the following: The apnea-hypopnea index (AHI) of children with adenotonsillectomy (T&A) performed without frenectomy improved, but surgery did not resolve fully the abnormal breathing. Similar results were noted when frenectomy was performed simultaneously with T&A. Finally, frenectomy on children two years or older without enlarged adeno tonsils also did not lead to normalization of AHI. The changes in orofacial growth related to factors including short lingual frenulum lead to SDB and mouth-breathing very early in life. Recognition and treatment of short frenulum early in life—at birth, if possible—would improve normal orofacial growth. Otherwise, myofunctional therapy combined with education of nasal breathing is necessary to obtain normal breathing during sleep in many children.

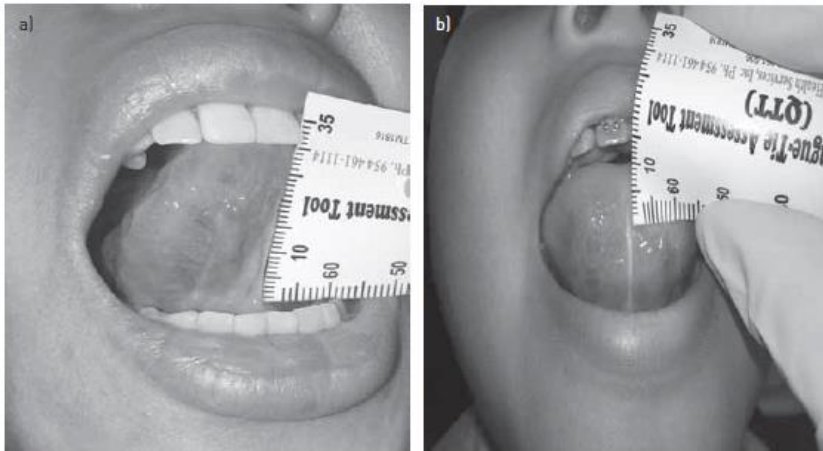
Table 1: Disease characteristics at entry and after first treatment

	At entry		After 1 <sup>st</sup> treatment	
	n (%)		n (%)	
<i>Demographics (n=27)</i>				
Boys	18 (63%)			
Mean Age (years) (SD)	11.4 ± 5.2		12.3 ± 4.6	
<i>Disease characteristics</i>				
Overall symptoms	27	(100)	9	(90)
Fatigue	27	(100)	10	(37)
EDS	9	(35)	1	(4)
Poor sleep	18	(67)	9	(33)
Snoring	20	(74)	2	(7.5)
Speech problems+	13	(48)	2	(7.5)
Swallowing problems+	7	(26)	0	(0.0)
Chewing problems+	6	(22)	1	(3.7)
<i>Tonsil scale</i>				
0/1	8	(30)	18	(66.6)
2	9	(33)	9	(33)
3	5	(18.5)	0	(0.0)
4	5	(18.5)	0	(0.0)
Mouth breathing	27	(100)	25	(92.5)
<i>PSG findings</i>				
AHI, mean ±SD	12 ± 4.6		3 ± 2	
SaO <sub>2</sub> nadir, mean ±SD	89 ± 2.5		94 ± 1.6	
Flow limitation, mean ±SD	73 ± 11		31 ± 9	
Mouth breathing (%TST)	78 ± 14		61 ± 16	

+ indicates that symptom was reported during pre-pubertal period but not present necessarily at time of evaluation

**Conclusion: Short lingual frenulum may lead to abnormal orofacial growth early in life, a risk factor for development of SDB. Careful surveillance for abnormal breathing during sleep should occur in the presence of short lingual frenulum.**

# A frequent phenotype for paediatric sleep apnoea: short lingual frenulum



**FIGURE 1** Measurement of the frenulum using the commercially available Quick Tongue Tie Assessment Kit (Neo Health Services Inc., Coconut Creek, FL, USA). a) Normal frenulum [9]; b) free tongue [7]. Complete clinical protocols for lingual frenulum investigations for infants [13] and children-adolescents [25] have been published.

**TABLE 1** Demographic and clinical presentation of children with obstructive sleep apnoea syndrome with short and normal lingual frenula

	Subjects	Short frenulum	Normal frenulum	p-value
<b>Subjects</b>	150	63	87	
<b>Age years mean±SD (n/N)</b>	150	9.88±3.21 (63/150)	8.05±3.59 (87/150)	0.0015
<b>Females</b>	58	29/63 (46)	29/87 (33)	0.1288
<b>Symptoms</b>				
Fatigue	147	61/63 (96)	86/87 (98)	0.5725
EDS	73	35/63 (55)	38/87 (43)	0.1859
Inattention/hyperactivity	90	43/63 (68)	47/87 (54)	0.0926
<b>Anatomy</b>				
High and narrow palatal vault	63	56/70 (80)	7/80 (8.75)	0.0001
Friedman tonsil score	150	1.8±0.9	3.2±0.9	0.0001
Mallampati scale score	150	3.4±0.6	2.9±0.7	0.0001
<b>Past medical history</b>	150			
Difficulty sucking		6	0	
Difficulty swallowing		4	0	
Speech problems		31	0	

Data are presented as n, n/N (%) or mean±SD, unless otherwise stated. Feeding and swallowing difficulties were poorly recollected, except in a few cases where the problem was mentioned as "important"; the speech problems were better recalled and were described as "lisp", "stutter" or having led to speech therapy, mostly in school (n=15). Despite speech therapy, the presence of a short lingual frenulum had not been investigated or mentioned to parents. EDS: excessive daytime sleepiness.

# Short lingual frenulum as a risk factor for sleep-disordered breathing in school-age children

Maria Pia Villa <sup>a,\*</sup>, Melania Evangelisti <sup>a</sup>, Mario Barreto <sup>a</sup>, Manuela Cecili <sup>a</sup>, Athanasios Kaditis <sup>b</sup>

**Table 3**

Multivariate logistic regression model assessing the association between a short lingual frenulum and risk of sleep-disordered breathing (positive Sleep Clinical Record) after adjustment for age, sex, tongue strength, and presence of obesity.

Dependent variable: positive Sleep Clinical Record	B	SE	P	Odds ratio	95% Confidence interval	
					Lower	Upper
Sex	-0.620	0.438	0.157	0.538	0.228	1.268
Age	-0.023	0.112	0.834	0.977	0.784	1.216
Obesity	0.092	0.601	0.878	1.097	0.338	3.559
Mean tongue strength (measured by IOPI)	-0.009	0.018	0.625	0.991	0.957	1.027
Short lingual frenulum	1.092	0.436	0.012	2.980	1.269	6.997
Constant	-1.887	0.956	0.049	0.152		

IOPI, Iowa Oral Performance Instrument; SE, standard error.

***Conclusions: Short lingual frenulum is a risk factor for SDB. An early multidisciplinary approach and screening for SDB are indicated when this anatomical abnormality is recognized.***



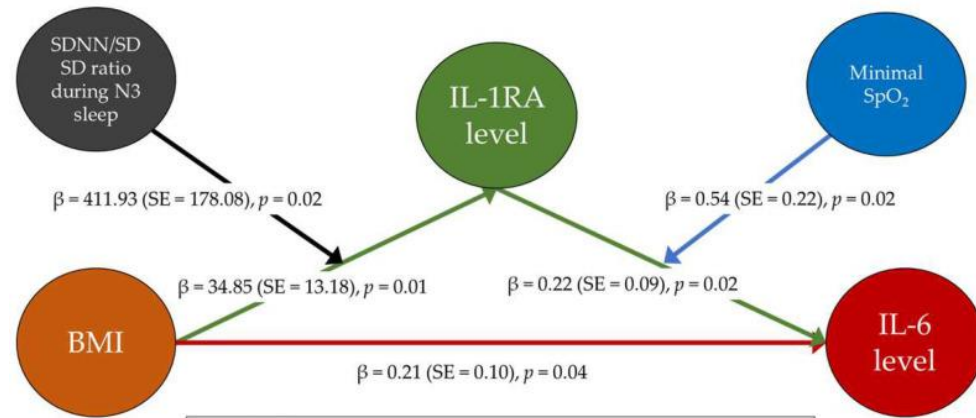
Obesità

**Table 1.** Studies that have analyzed obesity as a pediatric OSA risk factor.

Study	Year	Type of Study	Patients Number	Age	Parameters Evaluated	Conclusions
Arens R et al. [18]	2018	Case-control study	44	12.5 ± 2.8	Anatomical findings in obese children affected by OSAS compared to the ones in obese children	Significant upper airway lymphoid hypertrophy in obese children with OSAS. Larger parapharyngeal fat in obese children with OSAS but not a direct association with severity of OSAS or with obesity
Su M. et al. [21]	2016	Epidemiological study	5930	3–11	Age and sex; AHI; Arousal index; BMI; Mallampati; AT hypertrophy; Nocturnal/daytime symptoms	No positive correlation between OSA and BMI
Xu Z. et al. [26]	2008	Case-control Study	198	10.3 ± 2.1	Age and sex; BMI; Waist circumference; Neck circumference; Waist-to-Height Ratio; Symptoms; AHI, Obstructive Apnea Index, Central Apnea, MinSaO <sub>2</sub> ; AT hypertrophy	Positive relation between OSAS and degree of obesity
Andersen I.G. et al. [30]	2019	Longitudinal study	62	13.4 ± 3.1	Age and sex; BMI; AT hypertrophy; AHI; Sleep time (hours); ODI	AHI normalization in 44% of patients and positive correlation between BMI and AHI parameters

## OBESITY

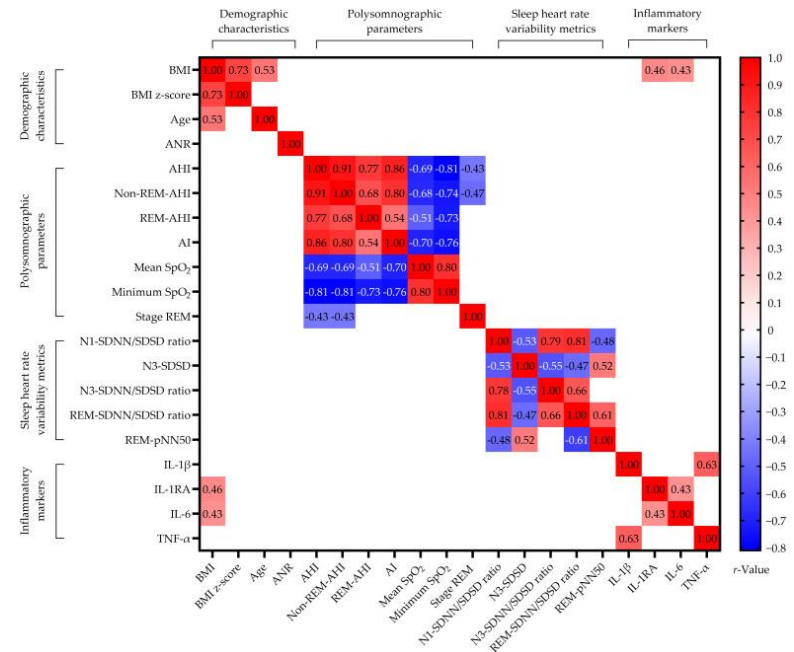
# Weight Status, Autonomic Function, and Systemic Inflammation in Children with Obstructive Sleep Apnea



**Direct effect:**  
 $\beta = 0.21$  (SE = 0.10),  $p = 0.04$   
**Indirect effect:**  
 BMI → IL-1RA → IL-6:  $\beta = 0.09$  (SE = 0.08),  $p = 0.01$   
**Conditional effects:**  
 SDNN/SDSD ratio during N3 sleep:  $\beta = 7.70$  (SE = 3.05),  $p = 0.01$   
 Minimum SpO<sub>2</sub>:  $\beta = 0.02$  (SE = 0.01),  $p = 0.002$

This study highlights the complex relationships between BMI, polysomnographic parameters, sleep heart-rate-variability metrics, and inflammatory markers in children with OSA, underlining the importance of weight management in this context.

**Prevalence of OSAS is much higher in obese children and has been reported to range between 13% and 59%**



# Clinica: Notte /Giorno





# *Clinica: Notte*

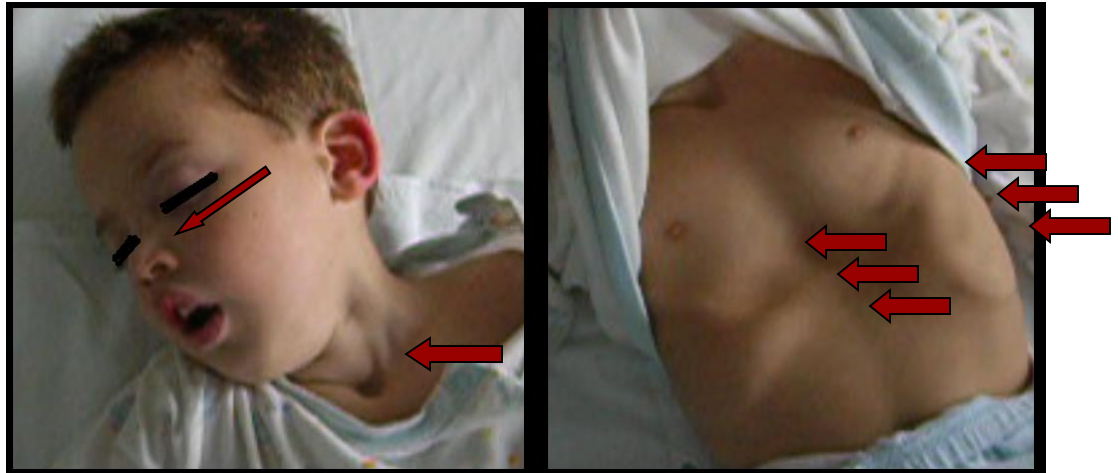


1) *Russamento*

2) *Apnee*

3) *Respiro orale*

- **Respirazione forzata**
- **Rientramento delle pinne nasali**
- **Rientramenti al giugulo e intercostali**



- **Spesso sonno agitato, assunzione di posizioni particolari**
- **Sudorazione profusa.**

# Clinica:Giorno

**Durante il giorno i sintomi ‘più caratteristici’ sono:**



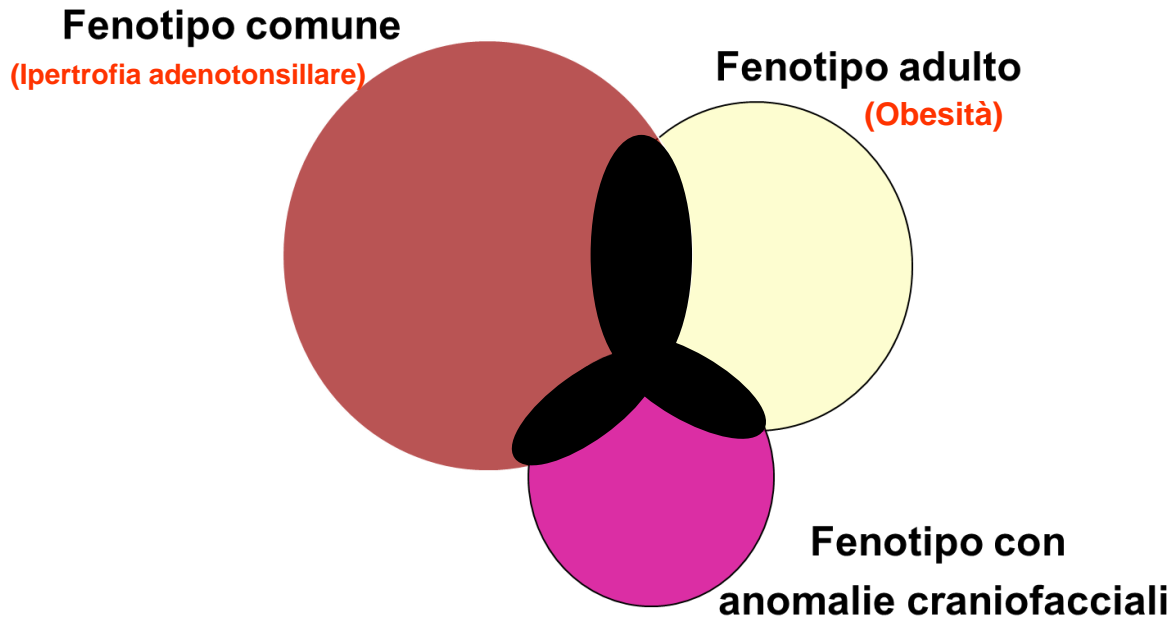
- **l'iperattività**
- **la presenza di deficit attentivo con conseguente scarso rendimento scolastico e irritabilità**
- **La sonnolenza risulta un sintomo meno frequente nel bambino rispetto all'adulto, solo il 20%, infatti, riferisce stanchezza o sonnolenza diurna e questo è prevalente nei bambini più grandi.**

*FENOTIPI BAMBINI CON DRS:*

BAMBINI CON OSAS  
ALTRIMENTI SANI

BAMBINI CON DISORDINI  
COMPLESSI CON OSAS

# ***FENOTIPI BAMBINI CON DRS:***



**Osservare il frenulo linguale !!**

## Fenotipo classico: 'facies adenoidea'.



- **Volto allungato (spesso asimmetrico)**
- **Espressione apatica, sofferente**
- **Occhi alonati**
- **Respirazione prevalentemente orale**
- **Labbra ipotoniche**
- **Le cartilagini alari ipotoniche**
- **Spesso dismorfismi del volto**

**E' caratteristica di questo fenotipo il palato ogivale e stretto / palato molle allungato.**

## Fenotipo classico :



- **Ipertrofia Adenotonsillare**
- **Le tonsille sono ipertrofiche e spesso occludenti.**

- **Può presentare 'pectus excavatum' a causa del lavoro e degli sforzi respiratori.**
- **Ritardo di crescita stature-ponderale**



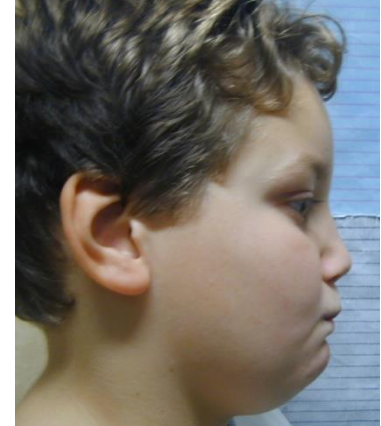
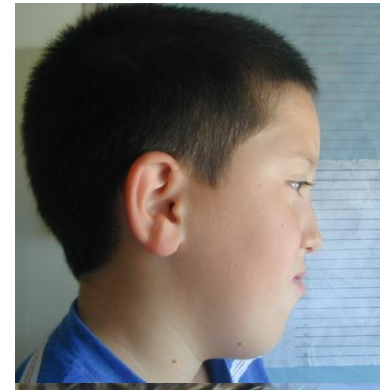
# Adult Type: (Adolescence - Obesity)



E' quello simile all'adulto caratterizzato da:

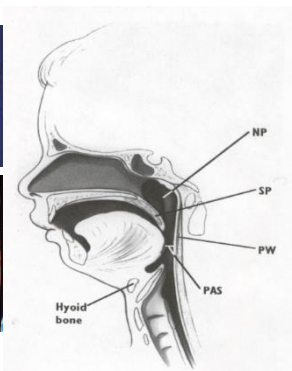
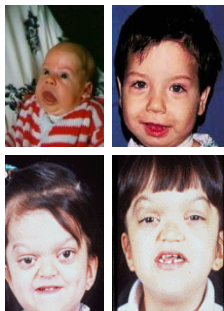
- **Obesità più o meno importante.**

- **Un collo corto e tozzo**
- Spesso **dimorfismi cranio facciali** caratterizzati da una riduzione della dimensione verticale del volto e da una riduzione del terzo inferiore del volto

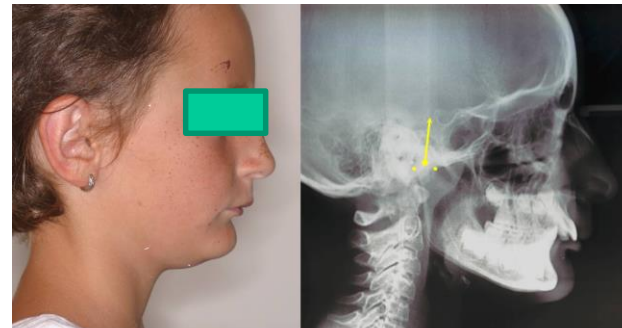


# Fenotipo congenito e/o con anomalie craniofacciali

**Caratterizzato prevalentemente da una *micrognazia*, *ipoplasia mandibolare*, *retrognazia*, *contrazione del mascellare* o *anomalie craniofacciali complesse*.**



*E. g. Pierre Robin syndrome*



**Fenotipo con anomalie craniofacciali:**

**La morfologia craniofacciale riscontrata nei b.ni con OSAS:**

- **Morso retruso,**
- **Palto ogivale,**
- **Contrazione del mascellare**
- **Malocclusione II classe**
- **Ipotonia linguale**
- **Incompetenza labiale**
- **Deglutizione atipica**

*FENOTIPI BAMBINI CON DRS:*



BAMBINI CON OSAS  
ALTRIMENTI SANI



BAMBINI CON SITUAZIONI  
COMPLESSE CON OSAS

## COMPLEX DISORDERS, UPPER AIRWAY OBSTRUCTION, AND OSAS

Combined phenotype of OSAS and sleep-related hypoventilation

- Craniofacial abnormalities
- Neuromuscular disorders
- Cerebral palsy
- Achondroplasia
- Chiari malformation
- Down syndrome
- Prader–Willi syndrome

# *Ministero della Salute*



## **LA SINDROME DELLE APNEE OSTRUTTIVE NEL SONNO (OSAS)**

Questo documento è stato preparato a cura del Gruppo di Lavoro “*Sindrome Apnee Ostruttive nel Sonno (OSAS)*”

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CLINICAL PRACTICE GUIDELINE

# Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

***Quando è  
indicata la  
Polisonnografia ?***

**TABLE 2** Symptoms and Signs of OSAS

**History**

- Frequent snoring ( $\geq 3$  nights/wk)
- Labored breathing during sleep
- Gasps/snorting noises/observed episodes of apnea
- Sleep enuresis (especially secondary enuresis)<sup>a</sup>
- Sleeping in a seated position or with the neck hyperextended
- Cyanosis
- Headaches on awakening
- Daytime sleepiness
- Attention-deficit/hyperactivity disorder
- Learning problems

**Physical examination**

- Underweight or overweight
- Tonsillar hypertrophy
- Adenoidal facies
- Micrognathia/retrognathia
- High-arched palate
- Failure to thrive
- Hypertension

<sup>a</sup> Enuresis after at least 6 mo of continence.

# Diagnosi di DRS : criteri clinici

## *I dati anamnestici che il pediatra deve riconoscere :*

- **Russamento abituale ( $\geq 3$  notti /settimana)**
- **Sforzo respiratorio durante il sonno**
- **Gasping/ respiro rumoroso nasale/ episodi di apnee**
- **Enuresi (soprattutto secondaria; enuresi dopo almeno 6 mesi di continenza)**
- **Dormire in posizione seduta o con il collo iperesteso**
- **Cianosi**
- **Cefalea al risveglio**
- **Sonnolenza diurna**
- **Deficit di attenzione e iperattività**
- **Disturbo dell'apprendimento**



# ERS Statement on obstructive sleep-disordered breathing in 1- to 23-month-old children

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ERS Task Force 2012-09

Athanasios Kaditis MD<sup>1</sup>, Maria Luz Alonso Alvarez MD<sup>2</sup>, An Boudewyns MD<sup>3</sup>,  
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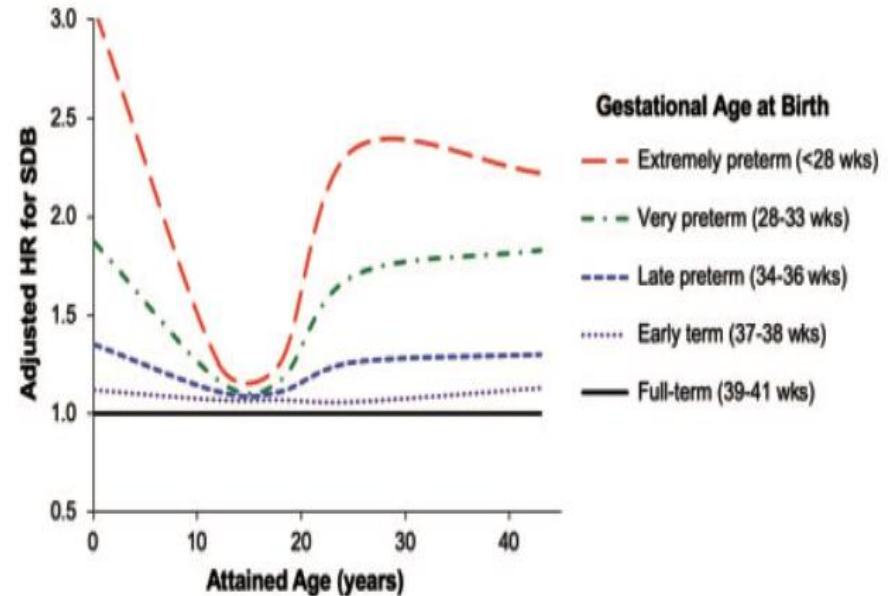


# Preterm birth and risk of sleep-disordered breathing from childhood into mid-adulthood

In this large national cohort study, we found a strong inverse association between gestational age at birth and risk of SDB from childhood into mid-adulthood.

After adjusting for other perinatal and maternal factors, preterm birth was associated with more than a 40% increased risk of developing SDB. Persons born extremely preterm had more than 2-fold risks.

These associations weakened from childhood into adolescence, but strengthened again in adulthood. Both males and females were affected, although preterm birth accounted for more SDB cases among males.



**Figure 1** Adjusted hazard ratios for sleep-disordered breathing (SDB) by gestational age at birth relative to full-term birth, Sweden, 1973–2015.

# Diagnosi di DRS: criteri clinici

*Aspetti clinici rilevanti nel bambino da 0 a 24 mesi di vita*

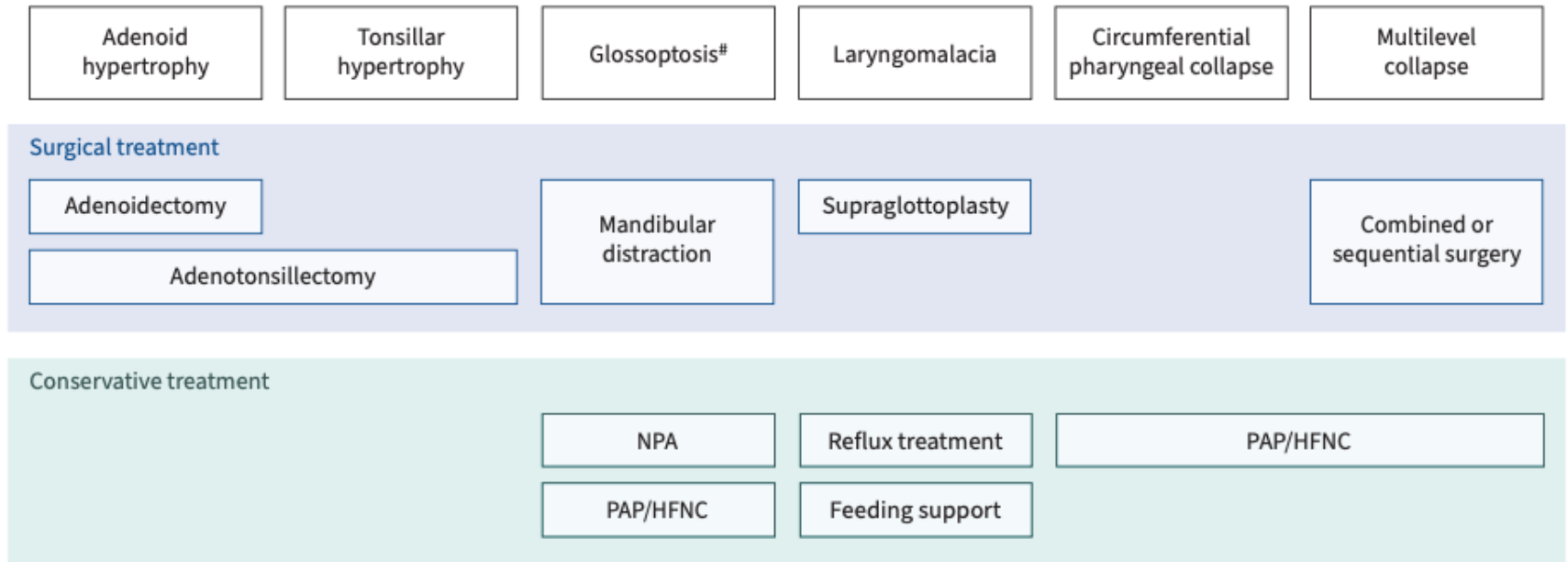
Nei primi due anni di vita i bambini con OSAS presentano come sintomi prevalenti il russamento notturno ed il respiro rumoroso, seguiti da apnee notturne, movimenti frequenti durante il sonno, respirazione orale e risvegli frequenti.

I fattori di rischio per l'OSAS in questa fascia di età sono prevalentemente:

- Anomalie craniofacciali
- Sindromi genetiche
- Acondroplasia
- Ostruzione nasale (infezioni respiratorie virali, atopia e atresia delle coane)
- Ostruzione laringea (laringomalacia, paralisi delle corde vocali congenita)
- Malattie neurologiche (paralisi cerebrale, atrofia muscolare spinale)
- Reflusso gastroesofageo
- Dopo i 6 mesi di vita prendere in considerazione l'ipertrofia adeno-tonsillare.



# An update on diagnosis and management of obstructive sleep apnoea in the first 2 years of life



**FIGURE 2** Upper airway findings and treatment options for obstructive sleep apnoea syndrome in children under 2 years of age. #: commonly seen in children with Pierre Robin Sequence. NPA: nasopharyngeal airway; PAP: positive airway pressure; HFNC: high-flow nasal cannula.

# Obstructive sleep disordered breathing in 2–18 year-old children: diagnosis and management

Athanasios G. Kaditis<sup>1</sup>, Maria Luz Alonso Alvarez<sup>2</sup>, An Boudewyns<sup>3</sup>, Emmanouel I. Alexopoulos<sup>4</sup>, Refika Ersu<sup>5</sup>, Koen Joosten<sup>6</sup>, Helena Larramona<sup>7</sup>, Silvia Miano<sup>8</sup>, Indra Narang<sup>9</sup>, Ha Trang<sup>10</sup>, Marina Tsaoussoglou<sup>1</sup>, Nele Vandebussche<sup>11</sup>, Maria Pia Villa<sup>12</sup>, Dick Van Waardenburg<sup>13</sup>, Silke Weber<sup>14</sup> and Stijn Verhulst<sup>15</sup>

## **STEP 4: Objective diagnosis and assessment of SDB severity:**

- 4.1** PSG or polygraphy if child at risk for SDB (see steps 1 and 2)
- 4.2** OSAS-definition 1: SDB symptoms in combination with obstructive AHI  $\geq 2$  episodes $\cdot h^{-1}$  or obstructive apnoea index  $\geq 1$  episode $\cdot h^{-1}$ ; OSAS-Definition 2: SDB symptoms and AHI  $\geq 1$  episode $\cdot h^{-1}$  (including central events)
- 4.3** If AHI  $> 5$  episodes $\cdot h^{-1}$  SDB unlikely to resolve spontaneously and child at risk for morbidity
- 4.4** If PSG or polygraphy not available: ambulatory PSG or polygraphy, nocturnal oximetry, Paediatric Sleep Questionnaire or Sleep Clinical Record



Pediatric Sleep Questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness, and behavioral problems<sup>☆</sup>

Ronald D. Chervin<sup>a,\*</sup>, Kristen Hedger<sup>a</sup>, James E. Dillon<sup>b</sup>, Kenneth J. Pituch<sup>c</sup>

<sup>a</sup>Department of Neurology, University of Michigan, Ann Arbor, MI, USA

<sup>b</sup>Department of Psychiatry, University of Michigan, Ann Arbor, MI, USA

<sup>c</sup>Department of Pediatrics and Communicable Diseases, University of Michigan, Ann Arbor, MI, USA

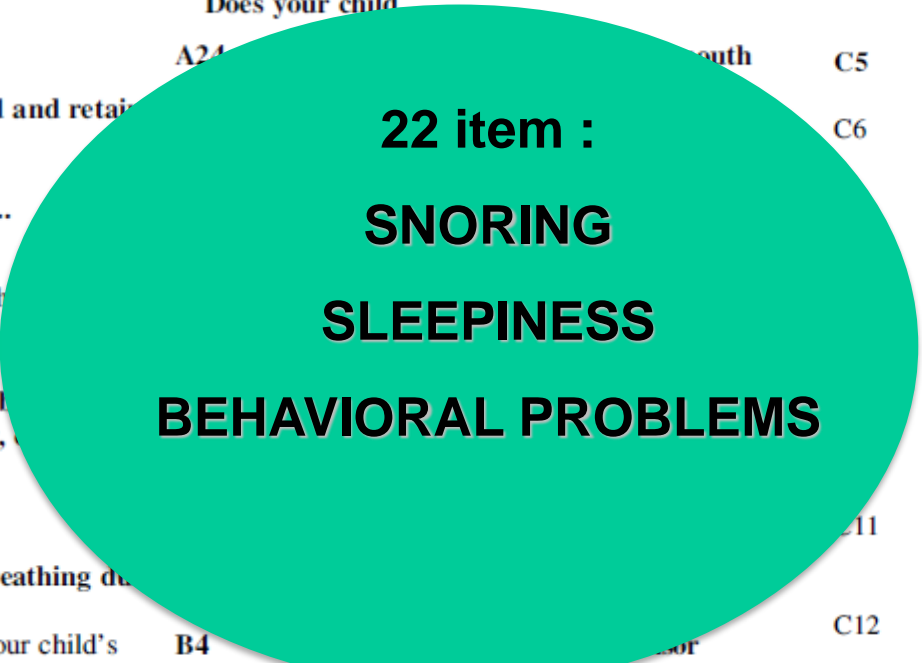
This child often ...

- C1 ... fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities
- C2 ... often has difficulty sustaining attention in tasks or play activities
- C3 ... **does not seem to listen when spoken to directly**
- C4 ... does not follow through on instructions and fails to finish schoolwork, chores or duties
- C5 ... **has difficulty organizing task and activities**
- C6 ... avoids, dislikes, or is reluctant to engage in tasks or activities that require sustained mental effort (such as homework or school-work)
- C7 ... loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books or tools)
- C8 ... is easily distracted by extraneous stimuli
- C9 ... is forgetful in daily activities
- C10 ... **fidgets with hands or feet or squirms in seat**
- C11 ... leaves seat in classroom or in other situations in which remaining seated is expected
- C12 ... runs about or climbs excessively in situations in which it is inappropriate
- C13 ... has difficulty playing or engaging in leisure activities quietly
- C14 ... **is 'on the go' or often acts as if 'driven by a motor'**
- C15 ... talks excessively
- C16 ... blurts out answers before questions have been completed
- C17 ... has difficulty awaiting his/her turn
- C18 ... **interrupts or intrudes on others (e.g. butts into conversations or games)**

- A17 At night, does your child usually get out of bed to urinate?
- A21 Does your child usually sleep with the mouth open?
- A22 Is your child's nose usually congested or "stuffed" at night?
- A23 Do any allergies affect your child's ability to breathe through the nose?

Does your child

- A24 ... mouth
- B4 ... commented that your child appears sleepy during the day?
- B5 Does your child usually take a nap during the day?
- B6 Is it hard to wake your child up in the morning?
- B7 Does your child wake up with headaches in the morning?
- B9 Did your child stop growing at a normal rate at any time since birth?
- B22 Is your child overweight?



22 item :

SNORING

SLEEPINESS

BEHAVIORAL PROBLEMS

Appendix A. Question-items tested and retained (in bold) for final scales

While sleeping, does your child...

- A1 ... ever snore?
- A2 ... **snore more than half the time**
- A3 ... **always snore?**
- A4 ... **snore loudly?**
- A5 ... **have "heavy" or loud breathing?**
- A6 ... **have trouble breathing, or do you have to help your child breathe?**

Have you ever ...

- A7 ... **seen your child stop breathing during the night?**
- A8 ... **been concerned about your child's breathing during sleep?**
- A9 ... had to shake your sleeping child to get him or her to breathe, or wake up and breathe?
- A11 ... **seen your child wake up with a snorting sound?**
- A12 Does your child have restless sleep?
- A15 At night, does your child usually become sweaty, or do the pajamas usually become wet with perspiration?

## Pediatric Sleep Questionnaire: Sleep-Disordered Breathing Subscale

Nome del bambino: \_\_\_\_\_

Persona intervistata: \_\_\_\_\_ Data: \_\_\_\_/\_\_\_\_/\_\_\_\_

Si prega di rispondere alle seguenti domande riguardanti le abitudini del tuo bambino durante il sonno o la veglia. Le domande si riferiscono alle abitudini che ha avuto il tuo bambino durante l'ultimo mese. Cerchia la risposta corretta rispondendo con SI, NO, Non So (NS).

1. MENTRE DORME, IL TUO BAMBINO:

Russa più della metà del tempo?.....	SI	NO	NS	A2
Russa sempre? .....	SI	NO	NS	A3
Russa forte? .....	SI	NO	NS	A4
Ha un respiro pesante o rumoroso? .....	SI	NO	NS	A5
Ha difficoltà a respirare o si sforza a respirare? .....	SI	NO	NS	A6

2. HAI MAI VISTO IL TUO BAMBINO FARE DELLE PAUSE RESPIRATORIE DURANTE LA NOTTE? .....

SI	NO	NS	A7
----	----	----	----

3. IL TUO BAMBINO:

Tende a respirare con la bocca aperta durante il giorno?.....	SI	NO	NS	A24
Al mattino, quando si sveglia, ha la bocca secca? .....	SI	NO	NS	A25
Occasionalmente bagna il letto? .....	SI	NO	NS	A32

4. IL TUO BAMBINO:

Si sveglia sentendosi poco riposato al mattino? .....	SI	NO	NS	B1
Ha problemi di sonnolenza durante il giorno? .....	SI	NO	NS	B2

5. GLI INSEGNANTI HANNO FATTO NOTARE CHE IL TUO BAMBINO APPARE ASSONNATO DURANTE IL GIORNO? .....

SI	NO	NS	B4
----	----	----	----

6. È DIFFICILE SVEGLIARE IL TUO BAMBINO AL MATTINO? .....

SI	NO	NS	B6
----	----	----	----

7. IL TUO BAMBINO SI SVEGLIA COL MAL DI TESTA AL MATTINO?.....

SI	NO	NS	B7
----	----	----	----

8. HA SMESSO DI CRESCERE REGOLARMENTE IN UN CERTO PERIODO DELLA SUA VITA.....

SI	NO	NS	B9
----	----	----	----

9. IL TUO BAMBINO È IN SOVRAPPESO? .....

SI	NO	NS	B22
----	----	----	-----

10. IL TUO BAMBINO SPESSO:

Non sembra ascoltare quando gli si parla direttamente? .....	SI	NO	NS	C3
Ha difficoltà ad organizzare compiti e attività? .....	SI	NO	NS	C5
È facilmente distratto da stimoli esterni? .....	SI	NO	NS	C8
Si agita con le mani o con i piedi o appare irrequieto quando sta seduto?.....	SI	NO	NS	C10
È sempre in movimento o agisce come se fosse ipercinetico? .....	SI	NO	NS	C14
Interrompe o si intromette fra gli altri (si inserisce dentro conversazioni o giochi)?.....	SI	NO	NS	C18

**GRAZIE!**

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# Occlusione scheletrica



RETROGNATICA    ORTOGNATICA    PROGNETICA

# Morso



# Contrazione del mascellare/ palato ogivale



# Ipertrofia Tonsillare

# Fenotipo classico

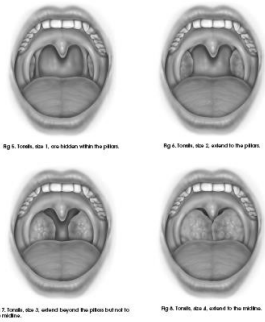


Fig. 5. Tongue, size 1, lies hidden within the palate.  
 Fig. 6. Tongue, size 2, adheres to the palate.  
 Fig. 7. Tongue, size 3, extends beyond the palate but not to the middle.  
 Fig. 8. Tongue, size 4, extends to the middle.

# Posizione palate (Friedman)

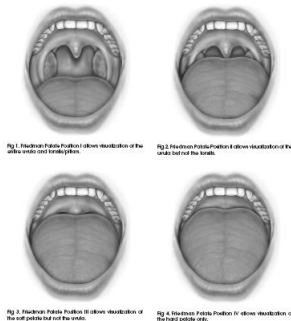


Fig. 1. Friedman-Palate Position I: shows visualization of the white teeth and hard palate.  
 Fig. 2. Friedman-Palate Position II: shows visualization of the white teeth but not the hard palate.  
 Fig. 3. Friedman-Palate Position III: shows visualization of the white teeth but not the uvula.  
 Fig. 4. Friedman-Palate Position IV: shows visualization of the hard palate only.

# Fenotipo con anomalie craniofacciali



# Fenotipo adulto

# Valutazione frenulo linguale



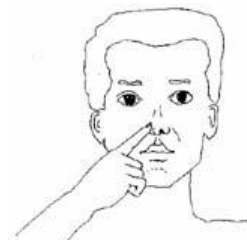
# Valutazione del naso e cavità



# obesità



# Pervietà nasale



**Eur Respir J. 2012**

**Sleep clinical record: a help to rapid and accurate diagnosis of paediatric sleep disordered breathing.**

Villa MP, Paolino MC, Castaldo R, Vanacore N, Rizzoli A,  
Miano S, Pozzo MD, Montesano M.

# **SLEEP CLINICAL RECORD**

**E' uno strumento di semplice utilizzo, validato con l'esame polisonnografico, creato al fine di ridurre l'uso della PSG.**

**Lo SCR consiste di 3 items, ad ognuno dei quali viene attribuito un punteggio, al fine di ottenere uno score totale :**

- **Valutazione fisica (0-16 punti)**

**+**

- **Sintomi soggettivi (0-1 punti)**

**+**

- **Problemi cognitivo- comportamentali (0-1 punti)**

## Se lo SCR raggiunge uno score $\geq 6,5$

**SENSIBILITA':**

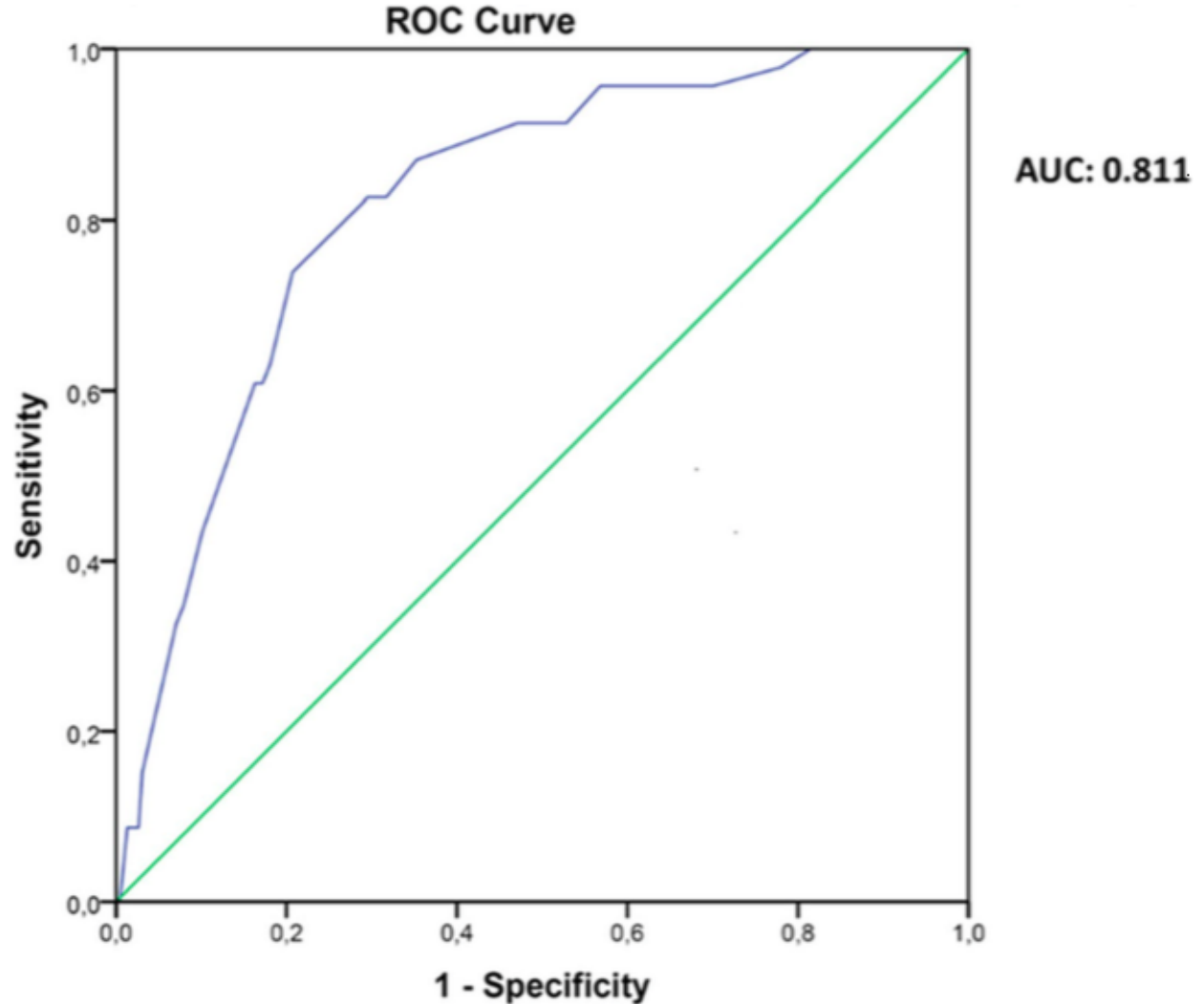
**96%**

**SPECIFICITA':**

**67%**

# Accuracy of the sleep clinical record for the diagnosis of pediatric moderate-to-severe obstructive sleep apnea syndrome

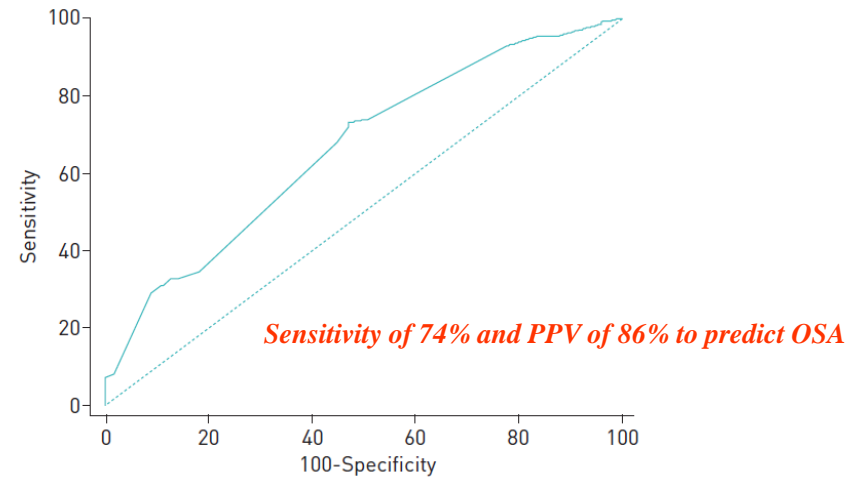
**Fig. 1** ROC curve analysis of SCR score in predicting AHI > 5 episodes/h. AUC and its corresponding 95% confidence interval was 0.811 (0.747–0.876) with  $P < 0.001$ . ROC, receiver operating characteristic; SCR, sleep clinical record; AHI, apnea–hypopnea index; AUC, area under curve



# Sleep clinical record: what differences in school and preschool children?

TABLE 1 Demographic and clinical differences between preschool and school-age children

	Preschool children (<6 years old)	School-age children (≥6 years old)	p-value
<b>Subjects</b>	292 (69.5)	128 (30.5)	
<b>Age years</b>	3.96±1.2	9.1±2.4	<0.0001
<b>Males/females</b>	191 (65.4)/101 (34.6)	83 (64.8)/45 (35.2)	0.369
<b>BMI kg·m<sup>-2</sup></b>	16.4±2.3	20.9±5.5	<0.0001
<b>BMI percentile</b>	55±34.8	79.6±37.6	<0.0001
<b>Obesity</b>			<0.0001
Yes	41 (14.5)	52 (40.6)	
No	238 (85.3)	76 (59.4)	
<b>SCR score</b>	8.4±2.2	7.9±2.6	0.044
<b>Obstructive sleep apnoea</b>			0.680
Yes	237 (81.2)	107 (83.6)	
No	55 (18.8)	21 (16.4)	
<b>AHI events·h<sup>-1</sup></b>	8.2±8.9	7.7±10.5	0.662
<b>Main presenting symptoms</b>			
Apnoea	253 (86.6)	82 (64.1)	<0.0001
Snoring	284 (97.3)	116 (90.6)	0.078
Restless sleep	205 (70.2)	79 (61.7)	0.424
History of adenotonsillectomy	3 (1.03)	4 (3.1)	0.465
Associated bronchial asthma	52 (17.8)	25 (19.5)	0.583
<b>SCR parameters</b>			
Nasal septal deviation	12 (4.1)	35 (27.3)	<0.0001
Oral breathing scoring	139 (47.6)	44 (34.4)	0.019
Nasal obstruction scoring	244 (83.6)	88 (68.8)	0.003
Arched palate scoring	263 (90.1)	100 (78.1)	0.011
Nasal secretions	168 (57.5)	62 (48.4)	0.139
Nasal mucosal hyperaemia	127 (43.5)	71 (55.5)	0.047
Inferior turbinate hypertrophy	162 (55.5)	91 (71.1)	0.006
Nasal hypotonia	93 (31.8)	28 (21.9)	0.047
Labial hypotonia	83 (28.4)	27 (21.1)	0.055
Saddle nose	97 (33.2)	17 (13.3)	<0.0001
Nasal patency	130 (44.5)	64 (50)	0.511
Habitual nasal obstruction	216 (74)	77 (60.2)	<0.0001
Tonsillar grading score	203 (69.5)	41 (32)	<0.0001
Friedman grading score	57 (19.5)	30 (23.4)	0.364
Angle class scoring	65 (22.3)	45 (35.2)	0.022
Retrognathia/prognathia	47 (16.1)/18 (6.2)	39 (30.5)/6 (4.7)	0.024
Open bite	52 (17.8)	11 (8.6)	0.017
Deep bite	103 (35.3)	43 (33.6)	0.711
Cross bite	72 (24.7)	40 (31.3)	0.151
Overjet	10 (3.4)	15 (11.7)	0.001
Skeletal malocclusion	226 (77.4)	96 (75)	0.902
Positive Brouillette score	248 (85)	99 (77.3)	0.131



**Ipotonia nasale, ostruzione nasale abituale, naso insellato, respirazione orale, palate ogivale morso aperto e ipertrofia tonsillare : ASPETTI PIU' RILEVANTI IN ETA' PRESCOLARE**

**Malocclusione, deviazione setto nasale, ed aumentato overjet PIU' COMUNI NEI BAMBINI IN ETA' SCOLARE**

Data are presented as n (%) or mean±SD, unless otherwise stated. BMI: body mass index; SCR: sleep clinical record; AHI: apnoea-hypopnoea index. Bold indicates statistical significance.

# CONCLUSIONI

- Esiste una gamma di varianza fenotipica nell'OSAS pediatrica a causa dei fattori anatomici che determinano un ridotto calibro delle vie aeree e anomalie che promuovono una maggiore collapsabilità delle vie aeree superiori, con comorbidità che incidono in modo significativo su entrambi gli elementi.
- È importante individuare precocemente i bambini a rischio di DRS per impostare il percorso diagnostico e terapeutico più idoneo il prima possibile ed evitare le complicanze.



Take it early...

**GRAZIE**